**Exchange Algorithm for the Traveling Salesman Problem**

A *k-exchange* is performed by deleting *k* edges of a tour, and reconnecting the segments so as to form another tour.

For a specified integer *k*, a *k*-neighborhood of a tour is one which might be obtained by a *k*-exchange.

If no shorter tour exists in a *k*-neighborhood of a tour, that tour is said to be *k*-optimal.

(Only if a tour is *k*-optimal for every *k* ≤ N/2 can we be certain that the tour is truly optimal.)

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**Exchange heuristics.** Given an initial tour, try to replace *k* edges of the tour with *k* edges not on the tour in order to find a shorter tour.

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**Example**

Random Symmetric TSP

(Seed: 135239)

**Initial tour**

(Found by nearest neighbor heuristic)

**Tour** 1 1 2 3 4 5 6 7 8 9 10 11 12 1

Length: 321  Improvements: 74

**Edges** (3, 4) & (11, 12) are removed, breaking tour into 2 paths. These can then be reconnected in only one other way.
Exchange type: 1
Replace edge (1,2) with (3,11) taking in 3-edge heuristic (1,2), (3,11), (4,12) having length 101
Tour 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 1, 3, 4, 12
Improvement: 74
Because edge (1,2) was re-inserted, this is actually a 2-neighboring tour.

No 2-neighbor tour gives any improvement.

Initial tour (found by nearest neighbor heuristic)

No further improvement was found.